International Journal of Dairy Science and Technology (IJDST) ISSN: 1716-3498, Vol. 4(2), pp. 225-237, September, 2020. Available online at www.advancedscholarsjournals.org © Advanced Scholars Journals

Review paper

Varieties of market milk and consumers perception – A review

Laguna Paredes CL[a]*, Rossmann B[a] and Schreiner M[b]

[*a]Institute for Food Safety Vienna, AGES Austrian Agency for Health and Food Safety, Spargelfeldstrasse 191, 1220 Vienna, Austria.

[b]Institute of Food Science, BOKU University of Natural Resources and Life Sciences, Muthgasse 18, 1190 Vienna, Austria.

Accepted 7 September, 2020.

As a natural product,cow´s milk is traditionally consumed for its high nutritional value. Its product quality can be influenced only by different farming practices, food technologies, or selection of breed. Any other manipulation of milk such as the use of additives is not permitted. Since producers always aim to point out special characteristics of their product, consumers are confronted with recently implemented namesof milk such as Haymilk, Meadow milk, Demeter milk or A2 milk. Consumers often negatively perceive terms connected with food technology (e.g. homogenization), whilst sustainability in connection with animal husbandry and farming practices is generally positively connoted.Dairy industry increasingly uses sustainability data e.g. minimized carbon and water footprints as marketing strategies. This information either is placeddirectly on the product or is provided on the company homepage.This review provides an overview of current varieties of cow'smilk in terms of production and consumers perception and discusses the real differences in milk quality.

Keywords: milk, extended shelf life,farming practices, A2 milk, health claims, lactose free milk, carbon footprint.

INTRODUCTION

Milk is considered a staple food worldwide and has been consumed for centuries in many countries. Constantly scientists and consumers putting in this product controversially and discuss its quality, nutritional value and the application of milk technology.

Marketing plays an essential role for commercializing products like milk, which do not exhibit differences that are self evidentfor the consumers. One of principal issues of marketing is to fulfil the wishes of the target audience, adapting the products to consumer´s requirements. The dairy industry is constantly reengineering to eliminate negative myths about milk consumption and thus strengthen the reputation of its products. But all applied technologies instantly induce questions about shelf life and nutritional value.

The technological treatment should not alter the product quality more than is necessary. During milk production; homogenisation and pasteurization are traditionally applied as basic treatments, aimed at providing a safe product with controllable quality and acceptable shelf life. Although milk is a safe product, producers are often confronted with public trends that cause a negative image of milk, such as increase of lactose intolerance, allergies or respiratory problems. In addition, the use of drugs in animal husbandry, especially antibiotics, contribute to a negative image of dairy products.

Marketing strategies are developedto promote a positive product image to the consumers. Wellbeing, feeding and farming practices, sustainability and healthiness all these aspects became increasingly important issues in milk marketing.

Farming practicesare complemented by advertising species genetic backgrounds of the cows, the geographical and topographical heritage and an appropriate tradition in husbandry. Sometimes the price increase itself causes the image of the product and indicates its outstanding quality.

Article 4 of EU regulation 1924/2006 (European Parliament and Council of the European Union,2006)says

*CorrespondingAuthorEmail:claudia-lourdes.laguna-paredes@ages.at

that health claims about products must have an accepted scientific evidence regarding the relationship between diet and health. In addition, nutritional values and composition of milk are favourable to promote different health claims.
In the following review, we present applied technologies and discuss different feeding and farming practices and their utilization in milk marketing.

Technology

Customer's perception of all kind of appliedfood technologiesshow strong effects on utilitarian and purchase attitudes. Therefore, technologies used during milk production have to be specified on the labelaccording to EC regulation 1169/2011(European Parliament and Council of the European Union, 2011).However, some technical terminologies can confuse the consumer and thus affect the acceptance of products.

Homogenization

Homogenization reduces the size of fat globules and allows stable dispersion of fat in milk along the entire shelf life.
Microfluidizers, two-stage valve homogenizers and high-pressure applications are examples for homogenization. Especially the impact on proteins forming the milk fat globule membrane and emulsification have been investigated in some studies. The type of homogenization, pressure or fat content do not influence oxidative stability(Cano-Ruiz, Richter, 1997; Michalski, Januel, 2006; Horn *et al.*, 2012).
Ultra high Pressure Homogenization, with pressure up to 400 MPa, at lower temperatures around 30°C, does not show any influence on the taste. This technology at optimal conditions (min. 300 MPa at approximately +50°C) additionally reduces bacterial count prior to pasteurisation and can therefore aid in improving milk quality(Pereda *et al.*, 2007; Huppertz, 2010).
Problems with milk digestion are often associated with the stage of milk processing. Korpela *et al.* (2005) affirm in her work that there is no influence of homogenization on lactose digestibility.
The disclaimer about using homogenization during milk production is mainly used in marketing of Demeter quality products and by very small producers.

Microfiltration and Centrifugation

Microfiltration and Centrifugation (bactofugation) are techniques used before pasteurization to reduce bacterial load in the product.
Microfiltration systems can be designed for continuous and discontinues batches. This process is carried out by application of pressure gradients between 1 to 10 bar and ceramic membranes with average pore diameters of 0.8 to 1.4µm. Colloidal and high molecular weight components such as spores and other forms of microorganisms are separated because they cannot permeate these membranes (Lorenzen *et al.*, 2011; Spreer, 2011).
Bactofugation is the process of removal of microorganisms from milk using centrifugal force(Faccia, 2013). A bactofugation system is composed of a centrifuge with high selectivity clarifying nozzles. Since the 1870´s, centrifuges are produced specifically for cheese production(Stack, Sillen, 1998).
Nowadays centrifuges are being used for separation of microbes and rough contamination of different milk products. As the plasma of cells has a higher density than milk, a considerable separation of spores and spore bearing cells can be achieved by centrifugation (Spreer, 2011).
Conventional Pasteurization (72-75°C/12-15 s) in addition is necessary to guarantee anacceptable long shelf life (min. 20 days) for milk with fresh characteristics(Cano-Ruiz, Richter, 1997).

Heat treatment (Pasteurization, UHT, sterilized milk)

Different heat treatment process were developed to guarantee a safe and microbiologically stable product (Claeys *et al.*, 2013). The specific heat load, expressed as time/temperature combination, classifies heat treatments. Application of heat treatment starts with low temperature pasteurisation (30 min at 63°C or 15 s at min. 72°C), followed by high temperature short time combination (HTST) and ultra high temperature (UHT).
Heating at low temperature - short time (15 sby minimum 72°C) is called low temperature - short time (LTST). Although it can eliminate potentially pathogenic vegetative microorganisms, spores survive this treatment and may still be able to sprout. HTST is a time temperature combination of some seconds and a minimum temperature of 85°C. Microbiological objectives are comparable with LTST (Spreer, 2011).
Typical UHT treatment are at minimum 135°C by 1 to 10s or until the sample is microbiological stable (Milchwirtschaftsverband, 2018; BundesministeriumSoziales Gesundheit Pflege und Konsumentenschutz, 2019). Its objective is to produce a sterile product without any microbial activity that can be stored at room temperature (Spreer, 2011).
In approximately the last 30 years, innovative technologies have been developed (Hoffmann *et al.*, 2006), with one objective, to provide milk with a longer shelf life and without an alteration of the freshness of taste.
This technology has grown in the market by leaps and bounds.It is called extended shelf life (ESL). ESL milk is produced by application of pasteurization techniques using temperatures belowultrahightemperature heat

Treatmentcombinedwithmicrofiltrationor bactofugation techniques (Bundesministerium Soziales Gesundheit Pflege und Konsumentenschutz, 2019). Still product qualities strongly depend on the microbiological status of the raw milk available for ESL milk production (Huck *et al.*, 2007; Doll *et al.*, 2017).

Aroma characteristics are not negatively influenced by technologies using moderate temperatures. Pereda *et al.* (2007) made a comparison between two technologies ultra-high pressure homogenization (UHPH) and heat treatments, where consumers could not detect any difference between these two differently treated milks. If the heat treatment temperature exceeds 134°C milk shows changes in the flavour, to a cooked flavour or other flavours, these changes are given by long storage and processing temperatures (Samaržija *et al.*, 2012).

Extended shelf life milk (ESL)

ESL treatment is a combination of two technologies, to give milk a longer shelf life without significantly changing its taste and physicochemical characteristics. It uses mechanic technology such as microfiltration or bactofugation with the objective to reduce the microbial load in the product as much as possible, followed by a low-temperature heat treatment (pasteurisation). The final product issensory equal to pasteurised fresh milk with a considerably extended shelf life of up to 4 weeks. The transport logistics of these products are simpler than that of pasteurised milk, which overcompensates the slightly higher costs in production.

Nadeshda (2011)wrote about the fast growing rates of ESL milk production in Russia, which is currently in the range of 40% per year. The advantages and improvements are the long shelf life between 10 and 25 days, consequently the transport from east to west and south to north is possible.

In Austria ESL milk is labelled with two terms, associated with the name of the food, depending of its heat treatment and the duration of its shelf life. “längerfrisch” consumers milk is indicating an extended freshness and is characterized by a maximum shelf life of 27 days. “längerhaltbar” consumers milk is related to an extended durability and a maximum shelf life of 45 days (Lorenzen *et al.*, 2011; BundesministeriumSoziales Gesundheit Pflege und Konsumentenschutz, 2019).

The actual consumption of ESL milk in Austria has exceeded the traditional pasteurised milk (Rossmann *et al.*, 2017), ESL Milk started to become predominant. Consumption of ESL milk increased by 20% in the last 4 years(AgrarMarkt Austria, 2017b; 2017a), only between 2017 until July 2018 there was an escalation of production of 7,6% and a consume decrease of pasteurized conventional milk of 6.2% (AgrarMarkt Austria, 2018; 2019). Its success can be explained by its image as a “fresh” product (Doll *et al.*, 2017) combined with an elongated shelf life, convenient for consumers.

Lactose hydrolysis

Lactose hydrolysis in milk and dairy products is carried out with the aid of the enzyme lactase. This process is performed at moderate temperatures (between 10 and 35°C) to avoid formation of lactulose (laxative disaccharide) and should be able to work at lower temperatures (6-8°C). This is an important point for overnight process, and a relative pH optimum (pH 6-7) is required. In order to stop the hydrolysis and acidification a shock with high temperatures is applied (Dekker, Daamen, 2011).

Milk Image

Negative trends

The milk industry is confronted with a broad variety of studies indicating seriously negative effects of dairy consumption like osteoporosis (Michaelsson *et al.*, 2014), cardiovascular or skin diseases (Melnik, 2009; Soedamah-Muthu *et al.*, 2011), respiratory problems and cancer (Chagas *et al.*, 2012).

Bartley, McGlashan (2010) support their own hypothesis concerning a genetic A1/A2 polymorphism causing potential production of mucus from MUC5AC glands in respiratory tract, relating it with consumption of beta-casomorphin 7 (BC-7) contained in A1 milk.

Alternative medicine agrees with the results of these studies. In some cases abstinence of milk and dairy products are recommend, if inflammatory disease of the lower respiratory tract is present (Temelie, 2017).

In this context, Wuthrich *et al.* (2005) reported about the production of mucus in the respiratory tract or relationship with asthma by consuming cow milk or beverages with similar physical characteristics (soy-based beverages), claiming that both beverage types have similar sensorial properties. Consumption of milk could not be linked to asthma in this study. People who assumed that milk increases mucus production, reported changes in sensory perceptions related to mucus formation. Owing emulsion characteristics of these beverages were detected symptoms of increased of mucus formation in healthy adults. This suggests that mucus production could occur after intake of any emulsion drink, not only milk.

Milk-free diets are related to some sickness for example acrodermatitisenteropathica(Lakdawala, Grant-Kels, 2015).

Antibiotics in milk production

Antibiotics are often used to prevent illness and sometimes to try to increase yield performance. The principal problem in dairy cows is the control of the presence of somatic cell counts (SCC) from the first lactation, particularly the first 30 days, to cumulative

milking time (Archer *et al.*, 2014). Emanuelson *et al.* (1988) affirm a moderately high relationship between genetic and presence of SCC and also suggest that trait of SCC are different in first lactation to following lactation periods.
Elevated SCC is associated with mastitis, which is relatedto not only economic losses, but also clinical complications as premature culling and death are related. Clinical mastitis begins within the first 30 daysespecially in heifer´s by the first lactation(Oliver *et al.*, 2003; Rollin *et al.*, 2015)
Use of antibiotics for mastitis prevention can help to keep cows in production, but are associated with other problems, such as a selection of resistant bacterial strains and unwanted residues in in the milk.
Prepartumintramammary antibiotic infusion of the heifers mammary glands at 7 or 14 days before expected parturition is an effective treatment to prevent infections in heifers during the late lactation or first lactation (Oliver *et al.*, 2003). Milk production is higher in heifers treated with antibiotics (Merrill, 2018), which after a European study (Thomas *et al.*, 2015) shows heifers with low antibiotic resistance. Between the treatment and consumption of food, a withdrawal period is necessary to safeguard human from exposure to a low dose of antibiotics present in food and thus avoiding resistance on them.
Many studies about antibiotics show the impact on human health and deposition of antibiotic residues in food (meat, milk, eggs) (Stalder *et al.*, 2018). Antibiotic use and residues are strictly regulated in foodstuffs by the EU regulation 470/2009(European Parliament and Council of the European Union, 2009).

Hormones of natural origine in the milk

Milk production is based on the capacity of pituitary gland to produce hormones oxytocin and prolactin. Also present are hormones as steroids including oestrogens, progesterone, corticoids and androgens. The existence of other hormones such as insulin-like growth factor-1 (IGF-1) and local hormones including prostaglandins, as explained by Malekinejad, Rezabakhsh (2015). Cow hormones will not provoke biological effects in other species, because of the absences of its receptors and its steroid nature.
Bovine somatotropin (rbST) is used for increasing stimulation and milk production. rbST could produce health problems in the animal but not in humans (Canadian Veterinary Medical Association, 1998).
Steroid hormones concentration in milk is very low (Malekinejad, Rezabakhsh, 2015), lower than some contraceptives (Parodi, 2012). Threshold value for the intake of three servings of whole milk, represents 0.01 to 0.1% of daily production rates in human beings, these levels are below current guidelines for safe consumption (Chagas *et al.*, 2012). Hartmann *et al.* (1998) affirm that if the concentration of progesterone is higher in milk with more fat, the hormones produced by the consumer will be higher.
There are not enough reports to confirm a relationship between health complaints and hormones contained in milk (Baumrucker, Magliaro-Macrina, 2011). As shown in a survey in 2006 (Jouan *et al.*, 2006), hormones present in milk may contribute to the growth of a new born.

Positive arguments

Despite all arguments, postulating gives no negative effects of milk for consumption, official recommendations still include milk as an essential dietary component. Recommendations for consumption of milk and milk products, published by the Animal and Plant Health Inspection Service, in Food and Nutrition Service (2003)were practically unchanged since 1992(Dror, Allen, 2018).Milk portions have been recommended since 2010 by the Austrian Federal Ministry of Health and Women, minimal three daily portions (BundesministeriumSoziales Gesundheit Pflege und Konsumentenschutz, 2020)preferringtwowhiteportions (milk, yogurt, buttermilk) andoneyellowportion (cheese) (Weaver *et al.*, 2013).
The European Union recommends an increased share of milk and milk products in the diet of children at the stage when their eating habits are being formed, especially in scholar age (EU) No 1308/2013 (European Parliament and Council of the European Union, 2013).
Thorning *et al.* (2016)concluded that ingestion of milk reduces risk of childhood obesity and in adults improves body composition and also facilitate loss weight during energy restriction. Furthermore, a beneficial effect on bone mineral density was assumed. Only prostate cancer showed inconsistent evidence in relation to milk consumption. AlsoMichalski, Januel (2006) affirmed that there is no conclusive evidence that dairy products, including homogenized milk, increase the risk of coronary heart disease in healthy persons.
Problems with milk digestion are often associated with the stage of milk processing. Korpela *et al.* (2005) affirm in their work that there is not influence of homogenization on lactose digestibility.

Naturally based approaches to promote udder health

Oudshoorn *et al.* (2012)analyzed the sustainability between conventional and automatic milking systems. It shows a higher milk production for cows which are milked automatically. Fat and protein contents are not variable, although it is known, that a high milking frequency could reduce fat content.Plants and plant extracts change the ruminal flora; also, variations in feed composition (for example additives) could have an influence on milk composition. Essential oils (EO) present in plants can exhibitantimicrobial properties (Baser, Buchbauer, 2010; Paşca*et al.*, 2015).

Use of EO can help to treat mastitis with a positive impact on milk yield. Additionally this could help to reduce antibiotic resistance in animals and humans (Tshegofatso, 2017).
Benchaar *et al.* (2006)on the other hand explain that the influence of EO depends on the stage of lactation, feed intake, diet composition and length of the trial.
Good dairy practices as well as good animal observation influence production success as studied by Stalder *et al.*(2018).

Position in the market

Milk is considered a staple product. It is defined, regulated and protected, in the common European market e.g. “milk” is defined by EU regulation No 1308/2013 (European Parliament and Council of the European Union, 2013):
“-Milk- means exclusively the normal mammary secretion obtained from one or more milkings without either addition to or extraction therefrom. The milk products in respect of which the animal species from which the milk originates is to be stated, if it is not bovine, and to lay down the necessary rules”.
EU regulation No 1308/2013, paragraph 128 (European Parliament and Council of the European Union, 2013) provides different categories of milk quality for producers regarding their price policy. Market prices for raw milk have been declining in Austria during the last 3 decades and were constantly under fifty cent per litre during the last 13 years.
Nutrition values of milk described above can be promoted as part of marketing strategies. Especially protein content is a factor that determines a high value. Due to its variation between 2.9 to 4.4% it has a considerable influence on nutritional and technological quality. Protein content is also a factor that determines the price for raw milk that is paid to the farmer, since it determines the yield in cheese production. Proteins help to adapt the homogeneity and texture and also increase nutritional values of the end products.
In public perception sheep, goat, buffalo and mares milk are in much better positions since the beginning of the 1980´s. Consumption of these alternative dairy products (yogurt, cheese, etc.) and consumers milk has increased over the last decades(Park, 2007; Mühlbacher, 2015). In this review, we will discuss mainly milk and its marketing methods used in the last 10 years.
Another marketing approach is done by advertising animal welfare during milk production taking into account feeding and farming practices.

Feeding and farming practices

Milk composition can be influenced by endogenous and exogenous factors like race, genetic, feeding, lactation time and health status of the animals (Töpel, 2007b). All these factors have been affected by the evolution of farming practices, to provide speciesappropriate husbandry and consumer satisfaction.
“Back to the roots" marketing strategies include different feeding and farming approaches as haymilk, meadow milk called in German sphere “Wiesenmilch” or “Blumenmilch” and milk produced under conditions that are claimed to be further developments of organic production.

Haymilk

Silage free milk now called haymilk, became popular because of it sensory characteristic (Kalač, Samková, 2010; The European Commission, 2016; ARGE, 2018) and it association with the natural way of production. Milk production in alpine regions is costlier due to topographic reasons.
Advertising a natural way of production can add market value to these products, which is neededto increase profit under these circumstances.
The term “haymilk” is registered as “traditional specialties guaranteed” (TSG) by the European Union (European Parliament and Council of the European Union, 2012b; The European Commission, 2016). This was an Austrian national project, to protect its traditional farming (The European Commission, 2016; AgrarMarkt Austria, 2019).
Use of haymilk for raw milk cheese manufacture in the Alp-regions is an old tradition of dairy farming. Dairy cows are fed without fermented feed (silage), which is a prerequisite for proper fermentation of hard cheese resulting in its typical taste. It shows low counts of clostridium spores, which reduces the risk of late bloating in cheese, which is responsible for considerable financial losses(The European Commission, 2016). There are strict rules to produce haymilk, from the minimum of grazing hours in summer to precise control of chemical additives and fertilizer determinations (ARGE, 2018).

Meadow milk

Meadow or pasture milk is specially produced in north and middle Europe, Netherlands and Sweden under clear rules under general terms and conditions from Grazing Foundation certification (Grazing Foundation, 2019). It regulates milk cattle freewheels.They have to graze in pastures from spring to autumn at least 120 days a year and for at least six hours per day.Also in Ireland regulated green areas are available to pasture.
A study in Denmark compared milking systems in an organic dairy farm. It showed that conventionally milked cattle, which is frequently in the meadows, produced less milk in comparison with the automatically milked cattle. Characteristics of milk or the health of animals was not affected (Oudshoorn *et al.*, 2012).
Zhai *et al.* (2018), affirmed that heavy grazing maintainsa highpercentage of crudeproteinin milk comparedto

other grazing intensities and that a moderate grazing should improve the quality and yield of forage as well as a sustainable livestock.
Meadow milk is usually assumed as organic milk; both of these terms evoke consumer´semotions related to health, sustainability and respect for the environment. Although the term "organic" is only a labelling for products produced under EU-Eco-regulation (EG) No. 834/2007 (The Council of the European Union, 2007) and not a feeding practice. Organic milk is a new consumer tendency as showed in a study of consumers of milk in Europe (Thøgersen *et al.*, 2019), which revealed a preference of organic over conventional production and domestic over imported products.
Benbrook *et al.* (2018) compared omega-6/omega-3 ratios in organic, meadow milk and conventional milk over 3 years. The study showed only minor differences between conventional and organic milk, on the other hand meadow milk showed a very low omega-6/omega-3 ratio (0.97) consequently higher content of omega three fatty acids.

Demeter milk

Anthroposophic agriculture", today called "Biodynamic farming", was introduced in Germany around 1925, when Rudolf Steiner reported in his lectures about "Humanities Foundation for the prosperity of agriculture". It was founded the Agricultural Experimental Circle of Anthroposophical Farmers (Vogt, 2001). During the 1930s, after some magazine publications of biodynamic philosophy, the "Demeter" quality seal" was introduced. Biodynamic based it´s concept on a sustainable system of producing farming products to human consumers, taking in to account the respect for the soil and the life that develops on it (Phillips, Rodriguez, 2006).
The Demeter concept is laid down in the Austrian Demeter Confederation policies introduced on the first of October 2018 in it guidelines of certification(Demeter Erzeugung und Verarbeitung, 2020). Annual production is around four million litres of milk in Austria (Demeter Erzeugung und Verarbeitung, 2017). It requires free husbandry, where animals have enough space for moving and there are respected own animal requirements. The contact with nature is very important for the development of cattle. Grazing at least twice weekly in winter and daily in summer is required. Feed (minimum 50% TM) should also be satisfying Demeter requirements (direct from a Demeter provider, only organic green feed, hay and grains), as specified in chapter 7.7,electric cattle trainers and prophylactic use of antibiotics are forbidden as shown in chapter 7.8., as shown in the Demeter guidelines(Demeter Erzeugung und Verarbeitung, 2018).
Cattles health and biodynamic are very important to help the complex digestion and metabolic process and keep the biodynamics the horns should not be cut. There is no sufficient scientific proof to justify some items of Demeter´s guideline, although there are studies about the influence of dehorning. For example(Baars, 2016) analysed and compared 34 milk pair samples from dehorned and horn bearing cattle. This study focussed on the investigation of proteomics (protein composition) and metabolomics (metabolites) as fingerprint in the milk. This was the first time this technique was applied to an animal product. Some changes were recorded between milk produced by cattle with and without horns.
Additives and high temperature treatment (ultra-high temperature and sterilization) are not permitted, and homogenization is restricted to certain limitations.
According to the guidelines, Demeter milk must not have a homogenization degree of more than 30% as assessed by the NIZO pipette method (Tetra Pak®, 2020). On the other hand, milk with homogenization rate less than 10% can be called "non-homogenized".
Commercial milk with shelf life not more than 14 days has a minimum homogenization grade of 75% and milk with a long shelf life, minimum 60 days, shows an 85% homogenization grade.Kusche *et al.* (2009)lead a survey on 82 Demeter milk farms and their customers to obtain information about relationship between consumption of biodynamic milk and milk intolerance.Only 20% of these farms had knowledge about intolerance among their customers. Consumers preferred biodynamic milk as a result of an improvement in their health. This investigation showed that different origins and processing of the milk can individually influence the consumer. The possible milk tolerance improvement would result in a purchase preference of fresh and non-homogenized product.Michalski, Januel (2006) and Nuora *et al.* (2018)found no differences between native and homogenized milk in terms of digestibility.

Genetic variation A1 & A2 milk

Milk raw protein is divided in three groups; casein, whey protein and non-protein nitrogenous compounds (NPN). This fraction of milk oscillates between 2.9% and 4.4% (Märtlbauer, Becker, 2016), its contents are influenced by different factors exogenic and endogenic; as healthy status, genetically determinate potential performance, lactation, feeding and especially belonging breed.
Milk casein is subdivided in four big amino acid groups, αs1-Casein, αs2-Casein, ß-Casein, κ-Casein and ß-casein derivates (γ1-, γ2- and γ3-Casein) as show in table 1. In cattle, the genetic variant A, dominates variations of ß-Casein.
Depending on genes, dairy cattle´s ß-Casein can be present as A1 or A2 or a hybrid between A1 and A2 genetic types (Cano-Ruiz, Richter, 1997). A1 milk is probably a genetic modification of the A2 variant. This hypothesis is based on the assumption that thismodification developed as a result of a selection processin Europe, which was driven by the objective to

raisemilkyield and carcass weight production (De Noni *et al.*, 2009).

This genetic mutation is located in the 67th position of its amino acid sequence (Banerjee, 2018), which carries a histidine in the A1 variant, whereas A2 contain a proline at this position(Mishra *et al.*, 2009; Banerjee, 2018).Beta-casomorphins are inactive amino acid parts, which released only after an enzymatic digestion and turns into bioactive peptides. ß-Casein A1 variant submits one of these ß-Casomorphins peptides, called beta-casomorphin 7 (BC-7) (a seven amino acid peptide). BC-7 gets released after pancreatic hydrolysis of ß-Casomorphins with histidine (Gödert *et al.*, 2017). The affinity of the opiate receptors of the human body with the endogenous opioids, cause a strong opioid peptide effect in the nervous system and in the intestinal tract (Mishra *et al.*, 2009; Gödert *et al.*, 2017). BC-7 is considering this kind of peptide, which means a disadvantage for A1 milk.

The beta casein variants (in particular A1, A2 and B) have received much attention from the scientific community because of their influence on milk technological properties and on human health (Mishra *et al.*, 2009). A1 milk is related,based in in-vitro studies and human trials, to different diseases such as coronary heart disease, Type 1 diabetes and Autism (Seebaum, 1998; Elliott *et al.*, 1999; Banerjee, 2018).

In her work Seebaum (1998) discussed that babies whose parents present Type 1 diabetes, have a high tendency to developed Type 1 diabetes, therefore recommended a long nursing period and a later introduction of milk substitute in the diet. On the other hand, there is a very critical review about these recommendations, which demonstrates that the influence of beta casein variant A1 is not strong enough to produce negative effects on human health.

Consumers milk produced in Europe is almost exclusively A1 variant, since this is genetically associated to all European cattle breeds e.g. such as Holstein-Friesian, Ayrshire and Red (Kamiński *et al.*, 2007; Woodford, 2008; Mishra *et al.*, 2009).

Table 1: Protein fraction

Casein (%)	**Genetic variation**	**Percentage of total protein**
α_{s1}	A, B, C, D, E	30.6
α_{s2}	A, B, C, D	8.0
ß	A1, A2, A3, B, B3, C, D, E	28.4
κ	A, B	10.0
γ_1[1]	A1, A2, A3, B	2.42
γ_2[1]	A2, A3, B	2.42
γ_3[1]	A, B	2.42

[1]derivate of ß-casein, 2 sum of all γ-casein, Märtlbauer, Becker (2016)

“Back to the roots” could be a good marketing strategy definition of A2 milk, that it is considered as the original milk. Actually, in Europe there exists retail A2 milk, sold at twice the price in comparison with the A1 milk variation. A2 milk is mostly produced by Guernsey and Jersey cattle and some Indian breeds (viz. Gir, Tharpakar, Rathi, and dual purpose breeds as Hariana and Kankrej, etc.) (Mishra *et al.*, 2009).A1 beta-casein consumers have higher Bristol Stool Scale (BSS) consistency values as A2 beta-casein consumers, which can be linked to BCM-7 release from the digestion tract. A2 digestion results in reduced BCM-7 development (Kamiński *et al.*, 2007), while proline could help to deal with lactose intolerance. Studies on the affinity of opiate receptors in humans should be deepened.

Further marketing strategies of milk.

Marketing strategies use neuro marketing to create bonds between emotions and conducts of consumers.These bonds are using slogans with texts, short statements or jingles. Claims are a simple, short and concise statement that enhances a product. It overstates different values and benefits from other products.

Claims (nutritional, health)

A health claim is any statement that explains or suggests that an ingredient or food has a particular health impact. In the European Union they have to comply with the provisions of the Health Claims Regulation (EC) N°1924/2006(European Parliament and Council of the European Union, 2006).

Compiling dossiers for submission of a new health claim including sufficient information and studies required for evaluation is a rather elaborate process(EFSA, 2019).

Authorized health claims are listed and explained in annex I of regulation (EC) N° 432/2012 (European Parliament and Council of the European Union, 2012a).

The nutrient reference values (NRV) of vitamins and minerals are listed in annex XIII of regulation N° 1169/2011 (European Parliament and Council of the European Union, 2011). The NRV is the basis for the applying conditions of health claims concerning vitamins and minerals. At least of 15% of NRV in foodstuffs of vitamins and minerals must be reached. Consumers milk contains 120mg/100g of calcium (15% NRV) and 0,410µg/100g of Vitamin B12 (16,4% NRV) (Souci et al., 2000).Vitamin B12 is little affected during pasteurization process (Wuthrich et al., 2005; Lucey, 2015), "this contributes to the reduction of tiredness and fatigue". "Calcium is needed for the maintenance of normal bones". These properties can be used as they are permitted by the health claim regulation (EC) N°1924/2006 (European Parliament and Council of the European Union, 2006) based on the scientific opinion of the European Food Safety Authority (EFSA) (EFSA, 2010).

Lactose free milk

Beyond being a marketing strategy lactose free milk is a different product in retail. Itwas developed as an offer to the growing group of lactose intolerant people.

Lactose intolerance is known as an insufficient activity of the lactase enzyme in the small intestine. It causes low or no hydrolysis of lactose, which results in a fermentation of lactose in the large intestine provoking gastrointestinal troubles.

Lactase enzyme turns lactose into glucose and galactose.This process allows digestion of lactose. In childhood, a sufficient amount of this enzyme is available. Activity of this enzyme is likely to diminish over lifetime, until almost a complete absence may occur, provoking diarrhoea, tympanites (excess gas accumulates in the gastrointestinal tract) or flatulence.

This degradation is frequently found in women and in Asian and African population. It is less common in children and in descendants from Northern Europe people(Dekker, Daamen, 2011).Natural contents of lactose in milk are around 4.7% (Töpel, 2007a), whereas in lactose free milk the upper limit is 0,1% lactose as declared by German Food Chemical Society and Austrian Nutritional Society.Lactose intolerance has existed since the beginning of humanity. Leonardi (2013) assessed the genetic and cultural evolution to tolerate lactose in our diet; this is shown in her work over the last years to develop new technologies to benefit the human. Regardless, lactose intolerance percentage was only 17% in the Finish population. In early 1970´s Finland was one of thepioneers in lactose hydrolysis technology,

through a recognized dairy company. It offered lactose free products based on lactase technology. In addition, an Italian company recognized this problem in the world population, in the late 60´s they began to produce easily digestible milk with lower fat content (Parmalat, 2020).

Austrian data indicates a fraction of lactose intolerant people about 21% in 2016. But only approximately 50% of them claimed to be lactose intolerant based on a medical diagnosis in web based interviews. (Das Statistik-Portal, 2017; Rossmann *et al.*, 2017). These data suggest that lactose free milk has a higher potential on the market than only filling a market niche (Vasiljevic, Jelen, 2002). In some European countries, such as Finland or Denmark, lactose free milk is already filling a significant market share in spite of their very lactose tolerant population.

Asiaand the US areidentified as trading areas with promising marketsfor consumers of lactose free productsas well (Vergari *et al.*, 2010).

Sustainability and environmental protection

Consumption of feed of animal origin like milk and meat leads to elevated emission of trace gases such as ammonia (NH_3), methane (CH_4), carbon dioxide (CO_2) and nitrous oxide (N_2O), as well as to a higher demand of water.

The result is a problematic ecological footprint connected to this area of food industry.

Therefore carbon footprint and water footprint are becoming increasingly used for estimating sustainable production and consumption. E.g. methane production in ruminants can be influenced by consumption of crude fiber and is positively correlated to live-weight and milk yield (Kirchgessner *et al.*, 1991).

A study from Southern Australia (Ridoutt *et al.*, 2011)calculated ranges from 10.1 to 12.7 kg CO_2e/kg live weight and water footprints ranging from 3.3 to 221 L H_2Oe/kg live weight. In their review,Knapp *et al.* (2014)expressed that greenhouse gaseshave been reduced with the help of studies in recent years, especially in intensively managed farms, arriving values lower than 1 kg of CO_2 equivalents (CO_2e)/kg of energy-corrected milk.

A good management of the herd, different types of animal physiology, feeding and nutrition should improve reduction of emissions (Aguerre *et al.*, 2011). Reduction in ruminal nutrient digestionalso causesa decrease in methane production as a result of feeding increase. More feeding produces high outflow rate of digest in the rumen, leaving less time for microbial fermentation. Also a big breed and higher milk production could help to reduce emission of CH_4(Yan *et al.*, 2010).

In Germany and Austria the dairy industry uses sustainability data as marketing strategies. Information either is placed directly on the product or is provided on company homepage. Data about CO_2 footprint is published more or less prominent and unfortunately, interpretation is rather difficult for consumers. The seals of quality are defined by a company´s own specifications.

CONCLUSIONS

Based on scientific data, milk can still be considered a healthy food. Different farming and feeding practices ensure a product of high value.

Initial microbial load can be very efficiently reduced by the help of thermal and mechanical treatments mainly pasteurisation and filtration techniques. Nevertheless,all applications of food technologies provoke ambiguous feelings among consumers, who generally prefer “natural” products, but appreciate a long shelf life and demand safety.

Therefore marketing points out different characteristics and values of milk, they are strongly connects with messages that emphasize wellbeing or contact with nature.

Three major fields of claims can be identified: nutrition, health and sustainability.

REFERENCES

AgrarMarkt A (2017a). Marktentwicklung Milch und Milchprodukte 3. Quartal 2016. [Access 19.12.2019]. Available on https://amainfo.at/

AgrarMarkt A (2017b). Milch und Milchprodukte. [Access 26.05.2020]. Available on https://amainfo.at/

AgrarMarkt A (2018). Marktbereich Milch und Milchprodukte. Marktbereich AMA, 7[Access 25.05.2020]. Available on https://www.ama.at/getattachment/f44ca46e-9346-49f6-a111-9515f8f8d0ba/MB_7.pdf

AgrarMarktA(2019). RichtlinieHaltung von Kühen 20.12.2019[Access 25.05.2020]. Available on https://amainfo.at/article/tierhaltung-1

Aguerre M, Wattiaux M, Powell J, Broderick G, Arndt C (2011). Effect of forage-to-concentrate ratio in dairy cow diets on emission of methane, carbon dioxide, and ammonia, lactation performance, and manure excretion. J Dairy Sci, 94(6): 3081-3093. Available from https://www.ncbi.nlm.nih.gov/pubmed/21605777. DOI 10.3168/jds.2010-4011.

Archer S, Mc Coy F, Wapenaar W, Green M (2014). Association between somatic cell count during the first lactation and the cumulative milk yield of cows in Irish dairy herds. J Dairy Sci, 97(4): 2135-2144. Available from https://www.ncbi.nlm.nih.gov/pubmed/24485671. DOI 10.3168/jds.2013-7158.

ARGE H (2018). ÖsterreichischesHeumilchregulativ. [Access 04.05.2020]. Available on https://www.heumilch.at/heumilch/heumilch-regulativ/

Baars T (2016). Hörner und Wärmeregulierung. LebendigeErde, 36. Available from https://orgprints.org/30401/1/Forschung_2016-3.pdf [Accessed 04.05.2020].

Banerjee S (2018). A2 Milk: The unknown story about a milk protein. Acta Scientific Nutritional Health, 2(3): 28-31. Available from https://actascientific.com/ASNH/pdf/ASNH-02-0057.pdf [Accessed 04.05.2020].

Bartley J, McGlashan S (2010). Does milk increase mucus production? Med Hypotheses, 74(4): 732-734. Available from https://www.ncbi.nlm.nih.gov/pubmed/19932941. DOI 10.1016/j.mehy.2009.10.044.

Baser K, Buchbauer G (2010). Handbook of essential oils science, technology and applications. KHCB Baser, G., (Ed.). Taylor & Francis Group.

Baumrucker C, Magliaro-Macrina A (2011). Hormones in milk. Encyclopedia of Dairy Sciences: 765-771. DOI 10.1016/B978-0-12-374407-4.00228-4.

Benbrook C, Davis D, Heins B, Latif M, Leifert C, Peterman L, Butler G, Faergeman O, Abel-Caines S, Baranski M (2018). Enhancing the fatty acid profile of milk through forage-based rations, with nutrition modeling of diet outcomes. Food SciNutr, 6(3): 681-700. Available from https://www.ncbi.nlm.nih.gov/pubmed/29876120. DOI 10.1002/fsn3.610.

Benchaar C, Petit H, Berthiaume R, Whyte T, Chouinard P (2006). Effects of addition of essential oils and monensin premix on digestion, ruminal fermentation, milk production,and milk composition in dairy cows. Journal Dairy Science, 89: 4352-4364.

Bundesministerium Soziales Gesundheit Pflege und Konsumentenschutz (2019). Codexkapitel/B32/Milch und Milchprodukte. Österreichisches Lebensmittelbuch, IV Auflage. Availablefromhttps://www.verbrauchergesundheit.gv.at/lebensmittel/buch/codex/B32_Milch_und_Milchprodukte.pdf?7a1jn9.

Bundesministerium Soziales Gesundheit Pflege und Konsumentenschutz (2020). 7Stufenzur Gesundheit. Available from https://www.sozialministerium.at/Themen/Gesundheit/Lebensmittel-Ernaehrung/Ern%C3%A4hrungsempfehlungen/Ern%C3%A4hrungspyramide0.html.

Canadian Veterinary Medical Association (1998). Report of the Canadian Veterinary Medical Association Expert Panel on rbST. In: The Canadian Veterinary journal.

Cano-Ruiz M, Richter R (1997). Effect of Homogenization Pressure on the Milk Fat Globule Membrane Proteins. Journal of Dairy Science, 80(11): 2732-2739. DOI 10.3168/jds.S0022-0302(97)76235-0.

Chagas C, Rogero M, Martini L (2012). Evaluating the links between intake of milk/dairy products and cancer. Nutr Rev, 70(5): 294-300. Available from https://www.ncbi.nlm.nih.gov/pubmed/22537215. DOI 10.1111/j.1753-4887.2012.00464.x.

Claeys WL, Cardoen S, Daube G, De Block J, Dewettinck K, Dierick K, De Zutter L, Huyghebaert A, Imberechts H, Thiange P, Vandenplas Y, Herman L (2013). Raw or heated cow milk consumption: Review of risks and benefits. Food Control, 31(1): 251-262. DOI 10.1016/j.foodcont.2012.09.035.

Das Statistik-Portal (2017). Sie haben angegeben, dass Sie an einer Laktoseintoleranz, Allergie oder sonstiger Unverträglichkeit von Milchprodukten leiden. Wurde diese Allergie bzw. Unverträglichkeit ärztlich bestätigt – wenn ja, von wem? – oder haben Sie das selbst festgestellt? [Access 04.05.2020]. Available on https://de.statista.com/statistik/daten/studie/732180/umfrage/unvertraeglichkeit-intoleranz-oder-allergie-gegenueber-laktose-in-oesterreich/

De Noni I, FitzGerald RJ, Korhonen HJT, Le Roux Y, Livesey CT, Thorsdottir I, Tomé D, Witkamp R (2009). Review of the potential health impact of β-casomorphins and related peptides. EFSA: pp: 1-107.

Dekker P, Daamen C (2011). Enzymes exogenous to milk in dairy technology | β-d-Galactosidase. In: EncyclopediaofDairySciences, JW Fuquay, (Ed.). pp: 276-283.

Demeter Erzeugung und Verarbeitung (2017). Milch muss 2 Euro kosten. [Access 04.04.2019]. Available on Https://www.demeter.de/aktuell/milch-muss-2-euro-kosten

Demeter Erzeugung und Verarbeitung (2018) Erzeugung und Verarbeitung Richtlinien für die Zertifizierung »Demeter« und »Biodynamisch«. Availablefromwww.demeter.de.

Demeter Erzeugung und Verarbeitung (2020) Richtlinie für die Zertifizierung Demeter und Biodinamisch. Available from https://www.demeter.de/leistungen/zertifizierung/richtlinien [Accessed 25.05.2020].

Doll E, Scherer S, Wenning M (2017). Spoilage of Microfiltered and Pasteurized Extended Shelf Life Milk Is Mainly Induced by Psychrotolerant Spore-Forming Bacteria that often Originate from Recontamination. Front Microbiol, 8: 135. Available from https://www.ncbi.nlm.nih.gov/pubmed/28197147. DOI 10.3389/fmicb.2017.00135.

Dror D, Allen L (2018). Overview of Nutrients in Human Milk. AdvNutr, 9(suppl_1): 278S-294S. Available from https://www.ncbi.nlm.nih.gov/pubmed/29846526. DOI 10.1093/advances/nmy022.

EFSA EFSA (2019). Nutrition applications: regulations and guidance.

Elliott R, Harris D, Hill J, Bibby N, Wasmuth H (1999). Type I (insulin dependent) diabetes mellitus and cow milk: casein variant consumption. Diabetologia, 42: 292-296. Available from https://doi.org/10.1007/s001250051153.

Emanuelson U, Danell B, Philipsson J (1988). Genetic parameters for clinical mastitis, somatic cell counts, and milk production estimated by multiple-trait restricted maximum ikelihood. Journal Dairy Science, 71(2): 467-476. Available from https://doi.org/10.3168/jds.S0022-0302(88)79576-4. DOI https://doi.org/10.3168/jds.S0022-0302(88)79576-4.

European Parliament and Council of the European Union (2006) Regulation (EC) No 1924/2006 of the european parliament and of the council of 20 December 2006 on nutrition and health claims on foods.

European Parliament and Council of the European Union (2009) Regulation (EC) No 470/2009 of the European Parliament and of the Council of 6 May 2009 laying down Community procedures for the establishment of residue limits of pharmacologically active substances in foodstuffs of animal origin, repealing Council Regulation (EEC) No 2377/90 and amending Directive 2001/82/EC of the European Parliament and of the Council and Regulation (EC) No 726/2004 of the European Parliament and of the Council (Text with EEA relevance).

European Parliament and Council of the European Union (2012a) Commission regulation (EU) No 432/2012 of 16 May 2012 establishing a list of permitted health claims made on foods, other than those referring to the reduction of disease risk and to children's development and health. [Accessed 26.08.2020].

European Parliament and Council of the European Union (2012b) Regulation (EU) No 1151/2012 of the European Parliament and of the Council of 21 November 2012 on quality schemes for agricultural products and foodstuffs.

European Parliament and Council of the European Union (2013) Regulation (EU) No 1308/2013 of the European Parliament and of the Council of 17 December 2013 establishing a common organisation of the markets in agricultural products and repealing Council Regulations (EEC) No 922/72, (EEC) No 234/79, (EC) No 1037/2001 and (EC) No 1234/2007.

European Parliament and Council of the European Union (2011) Regulation (EU) No 1169/2011 of the European Parliament and of the Council of 25 October 2011 on the provision of food information to consumers, amending Regulations (EC) No 1924/2006 and (EC) No 1925/2006 of the European Parliament and of the Council, and repealing Commission Directive 87/250/EEC, Council Directive 90/496/EEC, Commission Directive 1999/10/EC, Directive 2000/13/EC of the European Parliament and of the Council, Commission Directives 2002/67/EC and 2008/5/EC and Commission Regulation (EC) No 608/2004.

Faccia M (2013). Influence of the Milk Bactofugation and

Natural Whey Culture on the Microbiological and Physico-Chemical Characteristics of Mozzarella Cheese. Journal of Food Processing & Technology, 04(04). DOI 10.4172/2157-7110.1000218.

Food and NutritionService (2003). MyPyramidTechnicals Revisions. [Access 11.05.2020]. Available on https://www.fns.usda.gov/MyPyramidTechnicalRevisions

Gödert M, Brandt H, Erhardt G (2017). Beta-Casein A2 in Rindermilch – Hintergründe, züchterische und milchwirtschaftliche Strategien und Begrenzungen im Hinblick auf eine mögliche neue Nachfragesituation. Züchtungskunde, 89(6): 451-474.

Grazing Foundation (2019). General Terms and Conditions for Grazing and Meadow Dairy Products of the Grazing Foundation. Available on https://www.weidemelk.nl/en/

Hartmann S, Lacorn M, Steinhart H (1998). Natural occurrence of steroid hormones in food. Food Chemistry, 62(1): 7-20. DOI 10.1016/s0308-8146(97)00150-7.

Hoffmann W, Kiesner C, Clawinrädecker I, Martin D, Einhoff K, Lorenzen PC, Meisel H, Hammer P, Suhren G, Teufel P (2006). Processing of extended shelf life milk using microfiltration. International Journal of Dairy Technology, 59(4): 229-235. DOI https://doi.org/10.1111/j.1471-0307.2006.00275.x.

Horn A, Nielsen N, Jensen L, Horsewell A, Jacobsen C (2012). The choice of homogenisation equipment affects lipid oxidation in emulsions. Food Chem, 134(2): 803-810. Available from https://www.ncbi.nlm.nih.gov/pubmed/23107694. DOI 10.1016/j.foodchem.2012.02.184.

Huck J, Hammond B, Murphy S, Woodcock N, Boor K (2007). Tracking Spore-Forming Bacterial Contaminants in Fluid Milk-Processing Systems. Journal Dairy Science, 90: 4872–4883. DOI 10.3168/jds.2007-0196.

Huppertz T (2010). Foaming properties of milk: A review of the influence of composition and processing. International Journal of Dairy Technology, 63(4): 477-488. DOI https://doi.org/10.1111/j.1471-0307.2010.00629.x.

Jouan P-N, Pouliot Y, Gauthier SF, Laforest J-P (2006). Hormones in bovine milk and milk products: A survey. International Dairy Journal, 16(11): 1408-1414. DOI 10.1016/j.idairyj.2006.06.007.

Kalač P, Samková E (2010). The effects of feeding various forages on fatty acid composition of bovine milk fat: A review. Czech Journal of Animal Science, 55: 521-537.

Kamiński S, Cieślińska A, Kostyra E (2007). Polymorphism of bovine beta-casein and its potential effect on human health. Journal of Applied Genetics, 48(3): 189-198. DOI https://doi.org/10.1007/BF03195213.

Kirchgessner M, Windisch W, Muller H, Kreuzer M (1991). Release of methane and of carbon dioxide by dairy cattle. Agribiological research, 44: 91-102.

Knapp J, Laur G, Vadas P, Weiss W, Tricarico J (2014). Invited review: Enteric methane in dairy cattle production: quantifying the opportunities and impact of reducing emissions. J Dairy Sci, 97(6): 3231-3261. Available from https://www.ncbi.nlm.nih.gov/pubmed/24746124. DOI 10.3168/jds.2013-7234.

Korpela R, Paajanen L, Tuure T (2005). Homogenization of milk has no effect on the gastrointestinal symptoms of lactose intolerant subjects. Milchwissenschaft, 60: 3-6.

Kusche D, Sahm H, Baars T (2009). Konsum ökologischer Milch aus gesundheitlichen Gründen Eine qualitative Erhebung auf deutschen Demeter Milchviehbetrieben und bei ihren Kunden. In: J Mayer,TAlföldi,FLeiber,DDubois,PFried,FHeckendorn,E Hillmann,PKlocke,ALüscher,SRiedel,MStolze,FStrasser ,M van der Heijdenand H Willer, (Eds.) Verlag Dr. Köster, pp: 420-421.

Lakdawala N, Grant-Kels JM (2015). Acrodermatitisenteropathica and other nutritional diseases of the folds (intertriginous areas). Clinics in dermatology, 33(4): 414-419.

Leonardi M (2013). Lactase persistence and milk consumption in Europe: an interdisciplinary approach involving genetics and archaeology. DocumentaPraehistorica, 40: 84-96. DOI 10.4312/dp.40.8.

Lorenzen PC, Clawin-Rädecker I, Einhoff K, Hammer P, Hartmann R, Hoffmann W, Martin D, Molkentin J, Walte HG, Devrese M (2011). A survey of the quality of extended shelf life (ESL) milk in relation to HTST and UHT milk. International Journal of Dairy Technology, 64(2): 166-178. DOI 10.1111/j.1471-0307.2010.00656.x.

Lucey J (2015). Raw Milk Consumption: Risks and Benefits. Nutr Today, 50(4): 189-193 DOI10.1097/NT.0000000000000108.

Malekinejad H, Rezabakhsh A (2015). Hormones in Dairy Foods and Their Impact on Public Health- A Narrative Review Article. Iran Journal of Public Health, 44(6): 742-758. Available from http://ijph.tums.ac.ir.

Märtlbauer E, Becker H (2016). Milchkunde und Milchhygiene. H Becker (Ed.). Ulmer Verlag.

Melnik B (2009). Milk consumption: aggravating factor of acne and promoter of chronic diseases of Western societies. J DtschDermatolGes, 7(4): 364-370. Available from https://www.ncbi.nlm.nih.gov/pubmed/19243483. DOI 10.1111/j.1610-0387.2009.07019.x.

Merrill CE (2018). Immunological Responses and Protection in Dairy Cows Vaccinated with Staphylococcus aureus Surface Proteins (SASP) and

Staphylococcus chromogenes Surface Proteins (SCSP). University of Tennessee.
Michaelsson K, Wolk A, Langenskiold S, Basu S, Warensjo Lemming E, Melhus H, Byberg L (2014). Milk intake and risk of mortality and fractures in women and men: cohort studies. BMJ, 349: g6015. Available from https://www.ncbi.nlm.nih.gov/pubmed/25352269. DOI 10.1136/bmj.g6015.
Michalski M-C, Januel C (2006). Does homogenization affect the human health properties of cow's milk?
Trends in Food Science & Technology, 17(8): 423-437.DOI 10.1016/j.tifs.2006.02.004.
Milchwirtschaftsverband DNiI (2018) Wärmebehandlung von Milch - eine Übersicht. AvailablefromHttps://idf-germany.com/wp-content/uploads/2018/05/2018.01_Wärmebehandlung-von-Milch-ein-Überblick.pdf.
Mishra B, Mukesh M, Prakash B, Sodhi M, Kapila R, Kishore A, Kartaria R, Joshi B, Bhasin V, Rasool T, Bujarbaruah K (2009). Status of milk protein, b-casein variants among Indian milch animals. Indian Journal of Animal Sciences, 79(7): 722-725. Available from http://vedicilluminations.com/downloads/Society%20Science%20Art/Status%20of%20milk%20protein,%20beta-casein%20variants%20among%20Indian%20milch%20animals%20(A1,%20A2).pdf.
Mühlbacher J (2015). MilchziegenbetriebMuehlbacher. pp: 21-22.
Nadeshda F (2011). Der lustige Milchmann. Molkerei-Industrie, 09(11): 34-36.
Nuora A, Tupasela T, Tahvonen R, Rokka S, Marnila P, Viitanen M, Mäkelä P, Pohjankukka J, Pahikkala T, Yang B, Kallio H, Linderborg K (2018). Effect of homogenised and pasteurised versus native cows' milk on gastrointestinal symptoms, intestinal pressure and postprandial lipid metabolism. International Dairy Journal, 79: 15-23. DOI 10.1016/j.idairyj.2017.11.011.
Oliver S, Lewis M, Gillespie B, Dowlen H, Jaenicke† E, Roberts† R (2003). Prepartum Antibiotic Treatment of Heifers: Milk Production, Milk Quality and Economic Benefit. Journal of Dairy Science, 86(4): 1187-1193. DOI https://doi.org/10.3168/jds.S0022-0302(03)73702-3.
Oudshoorn F, Kristensen T, van der ZijppA, Boer Id (2012). Sustainability evaluation of automatic and conventional milking systems on organic dairy farms in Denmark. NJAS - Wageningen Journal of Life Sciences, 59(1-2): 25-33. DOI 10.1016/j.njas.2011.05.003.
Park Y (2007). Impact of goat milk and milk products on human nutrition. CAB Reviews: Perspectives in Agriculture, Veterinary Science, Nutrition and Natural Resources, 2(081). DOI 10.1079/pavsnnr20072081.
Parmalat (2020). History of Parmalat. [Access 14.05.2020]. Available on https://www.parmalat.com/en/about_us/history/history_of_parmalat/
Parodi PW (2012). Impact of cows' milk estrogen on cancer risk. International Dairy Journal, 22(1): 3-14. DOI 10.1016/j.idairyj.2011.08.006.
Paşca C, Mărghitaș LA, Dezmirean D, Bobiș O, Bonta V, Mărgăoan R, Chirilă F, Fit N (2015). The Assessment of the Antibacterial Activity of some Plant Extracts on Normal and Pathogenic Microflora from Milk. Animal Science and Biotechnologies, 48(1): 166-172.
Pereda J, Ferragut V, Quevedo J, Guamis B, Trujillo A (2007). Effects of Ultra-High Pressure Homogenization on Microbial and Physicochemical Shelf Life of Milk. Journal of Dairy Science, 90(3): 1081-1093. DOI https://doi.org/10.3168/jds.S0022-0302(07)71595-3.
Phillips JC, Rodriguez LP (2006). Beyond Organic: An Overview of Biodynamic Agriculture with Case Examples. pp: 1-15.
Ridoutt BG, Sanguansri P, Harper GS (2011). Comparing Carbon and Water Footprints for Beef Cattle Production in Southern Australia. Sustainability, 3(12): 2443-2455. DOI 10.3390/su3122443.
Rollin E, Dhuyvetter K, Overton M (2015). The cost of clinical mastitis in the first 30 days of lactation: An economic modeling tool. Prev Vet Med, 122(3): 257-264. Available from https://www.ncbi.nlm.nih.gov/pubmed/26596651. DOI 10.1016/j.prevetmed.2015.11.006.
Rossmann B, Aldrian U, Laguna Paredes C, Sun H (2017). Haltbarkeit und Konsum von Milch in der KonsumentInnensphäre. AGES - Wissenaktuell. Available on https://www.ages.at/wissen-aktuell/publikationen/haltbarkeit-von-milch
Samaržija D, Zamberlin Š, Pogačić T (2012). Psychrotrophicbacteria and milk and dairy products quality. Mljekarstvo, 62(2): 77-95.
Seebaum S (1998). Wertigkeit von A1- und A2-Antikörpern gegen ß-Casein beim Typ 1-Diabetes mellitus: Eine prospektive Familienstudie. In: Medizinisches Zentrum für Innere Medizin, Medizinische Klinik III und Poliklinik. Justus-Liebig-Universität Gießen.
Soedamah-Muthu S, Ding E, Al-Delaimy W, Hu F, Engberink M, Willett W, Geleijnse J (2011). Milk and dairy consumption and incidence of cardiovascular diseases and all-cause mortality: dose-response meta-analysis of prospective cohort studies. Am J ClinNutr, 93(1): 158-171. Available from https://www.ncbi.nlm.nih.gov/pubmed/21068345. DOI 10.3945/ajcn.2010.29866.
Souci SW, Fachmann W, Kraut H (2000). Food composition and nutrition tables. Medpharm GmbH Scientific Publishers: pp: 15-18.
Spreer E (2011). Milchverarbeitung. In: Technologie der Milchverarbeitung E Spreer, (Ed.). Behr`s Hamburg pp: 93-119.

Stack A, Sillen G (1998). Bactofugation of liquid milks. Nutrition & Food Science, 98(5): 280-282. Available from https://doi.org/10.1108/00346659810224217 [Accessed 2020/08/13]. DOI 10.1108/00346659810224217.

Stalder S, Sidler X, Hassig M (2018). Deskriptive Studie zur antibiotikafreien Milchproduktion beim Rind. Schweiz ArchTierheilkd, 160(12): 727-736. Availablefromhttps://www.ncbi.nlm.nih.gov/pubmed/30516475. DOI 10.17236/sat00188.

Temelie B (2017). Ernährung nach den Fünf Elemente. Oy-Mittelberg: by Joy.

Tetra Pak® (2020). 4 important questions about NIZO - Dairy Homogenization. 2020[Access 14.05.2020]. Available on https://processinginsights.tetrapak.com/4-important-questions-about-nizo-2/

The Council of the European Union (2007) Council Regulation (EC) No 834/2007 of 28 June 2007 on organic production and labelling of organic products and repealing Regulation (EEC) No 2092/91.

The European Commission (2016) Commission implementing Regulation (EU) 2016/304 of 2 March 2016: Entering a name in the register of traditional specialities guaranteed (Heumilch/Haymilk/Latte fieno/Lait de foin/Leche de heno (TSG)).

Thøgersen J, Pedersen S, Aschemann-Witzel J (2019). The impact of organic certification and country of origin on consumer food choice in developed and emerging economies. Food Quality and Preference, 72: 10-30. DOI 10.1016/j.foodqual.2018.09.003.

Thomas V, de Jong A, Moyaert H, Simjee S, El Garch F, Morrissey I, Marion H, Valle M (2015). Antimicrobial susceptibility monitoring of mastitis pathogens isolated from acute cases of clinical mastitis in dairy cows across Europe: VetPath results. Int J Antimicrob Agents, 46(1): 13-20. Available from https://www.ncbi.nlm.nih.gov/pubmed/26003836. DOI 10.1016/j.ijantimicag.2015.03.013.

Thorning T, Raben A, Tholstrup T, Soedamah-Muthu S, Givens I, Astrup A (2016). Milk and dairy products: good or bad for human health? An assessment of the totality of scientific evidence. Food Nutr Res, 60: 32527. Available from https://www.ncbi.nlm.nih.gov/pubmed/27882862. DOI 10.3402/fnr.v60.32527.

Töpel A (2007a). Lactose. In: Chemie und Physik der Milk. Behr´s: pp: 85-131.

Töpel A (2007b). Lipide - Milchfett. In: Chemie und Physik der Milch. Behr´s: pp: 133-147.

Tshegofatso N (2017). Antimicrobial properties of essential oils againgst bulk - tank milk isolated bacteria. In: Department of Life Science. Central University of Technology, Free State.

Vasiljevic T, Jelen P (2002). Lactose hydrolysis in milk as affected by neutralizers used for the preparation of crude β-galactosidase extracts from Lactobacillus bulgaricus 11842. Innovative Food Science & Emerging Technologies, 3(2): 175-184. Available from https://doi.org/10.1016/S1466-8564(02)00016-4.

Vergari F, Tibuzzi A, Basile G (2010). An Overview of the Functional Food Market: From Marketing Issues and Commercial Players to Future Demand from Life in Space. In: Bio-Farms for Nutraceuticals. Advances in Experimental Medicine and Biology, MT Giardi,G Rea and B Berra, (Eds.). Spring, Boston, MA: pp: 308-321.

Vogt G (2001). History of organic agriculture in the German-speaking region In: ÖKOLOGIE & LANDBAU. pp: 47-49.

Weaver C, Wijesinha-Bettoni R, McMahon D, Spence L (2013). Milk and dairy products as part of the diet. In: Milk and human nutrition in dairy products, E Muehlhoff,A Bennett and D McMahon, (Eds.). Food and Agriculture Organization of the United Nations, Rome: pp: 183-204.

Woodford KB (2008). A1 beta-casein, type 1 diabetes and links to other modern illnesses.

Wuthrich B, Schmid A, Walther B, Sieber R (2005). Milk consumption does not lead to mucus production or occurrence of asthma. J Am CollNutr, 24(6Suppl): 547S-555S. Available from https://www.ncbi.nlm.nih.gov/pubmed/16373954. DOI 10.1080/07315724.2005.10719503.

Yan T, Mayne C, Gordon F, Porter M, Agnew R, Patterson D, Ferris C, Kilpatrick D (2010). Mitigation of enteric methane emissions through improving efficiency of energy utilization and productivity in lactating dairy cows. Journal of Dairy Science, 93(6): 2630-2638.

Zhai X, Zhang Y, Wang K, Chen Q, Li S, Huang D (2018). Grazing effects on the nutritive value of dominant species in steppe grasslands of northern China. BMC Ecol, 18(1): 30. Available from https://www.ncbi.nlm.nih.gov/pubmed/30176859. DOI 10.1186/s12898-018-0186-8.